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SPECIFICATION FOR STUDENT-TYPE MICROSCOPE

(Third Reprint JANUARY 2000)

UDC 535.822

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 2 *October* 1966

AMENDMENT NO. 1 DECEMBER 1979
TO
IS:3686-1966 SPECIFICATION FOR STUDENT-TYPE MICROSCOPE

Alterations

(*Page 5, clause 4.6*) - Substitute the following for the existing clause:

'4.6 The case carrying the microscope shall be of well-seasoned wood or any other suitable material. When made of wood, the case shall be complete with lock and key arrangement, a suitable locking screw for securing the microscope and a cross piece to retain it in position during transit. The case carrying the microscope shall have suitable internal receptacles for holding the eye-pieces, objectives and accessories and may be provided with a carrying handle at the top. It should contain a cleaning brush and a bag of silica gel (regenerated) which should be suitably placed inside the case carrying the microscope.'

(*Page 8, clause 8.2, first sentence*) - Substitute the following for the existing sentence:

'All the objectives shall be placed in cylindrical containers which, in turn, shall be held in a suitable receptacle inside the box of the microscope.'

(*Page 8, clause 8.9*) - Substitute the following for the existing clause:

'8.9 The box along with its contents shall be properly secured during transit.'

(EDC 36)

Printed at New India Printing Press, Khurja, India

AMENDMENT NO. 2 OCTOBER 1980

TO

IS:3686-1966 SPECIFICATION FOR STUDENT-TYPE MICROSCOPE

Alterations

(*Page* 6, *clause* 6.1.3) - Substitute the following for the existing clause :

'6.1.3 In changing from lower magnification to next higher magnification or re-introducing the same objective by rotation of the nosepiece, the object at the centre of the field shall be well within the field of view,'

(*Page* 7, *clause* 6.2.5) - Substitute the following for the existing clause :

'6.2.5 When observed under white light illumination, the image shall appear clear and well defined. The image shall be totally free from colour defects up to half the field of view and shall be reasonably free from colour up to two-thirds field of view.'

(EDC 36)

Printed at New India Printing Press, Khurja, India

Indian Standard

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Indian Standard

SPECIFICATION FOR STUDENT-TYPE MICROSCOPE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 9 August 1966, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Student-type microscope is a laboratory instrument used in schools and colleges for the observation of minute objects under magnification.

0.3 This standard is one of a series of Indian Standards on optical instruments. Other standards published so far in the series are:

IS : 988-1959 General requirements for optical components
IS : 1399-1959 Glossary of terms used in optical technology
IS : 1400-1960 Specification for optical glass
IS : 2754-1964 General requirements for optical instruments
IS : 3081-1965 Dimensions and marking of general purposes microscopes
IS : 3099-1965 Specification for slides and cover slips for microscopes

Separate standards dealing with monocular dissecting microscopes, measuring (travelling) microscopes and pathological microscopes are under preparation.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the general and functional requirements of the student-type microscope.

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*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 1399-1959* shall apply.

3. DIMENSIONS

3.1 Dimensions for the student-type microscope shall conform to IS : 3081-1965†.

4. GENERAL REQUIREMENTS

4.0 The student-type microscope shall conform to the general requirements laid down in IS : 988-1959‡ and IS : 2754-1964§.

4.1 The construction of the microscope may be either of the hinged-limb type with the limb carrying the tube, or of the fixed-limb type; in the former case, it shall be possible to tilt the limb from the vertical to the horizontal position without affecting the equilibrium of the instrument. Provision shall be made for the coarse and fine focusing movement of the objective relative to the stage or *vice versa* depending on the type of construction of the limb. In case a condenser is provided, it shall be possible to move it relative to the stage.

4.2 All the materials used in the construction of the microscope shall conform to the requirements stipulated in IS : 2754-1964§.

4.3 The student-type microscope shall be provided with two achromatic dry objectives and two Huygenian-type eyepieces, one of low power and the other of high power. The preferred magnifications for objectives and eyepieces shall be as under:

Objectives	10× (NA 0·25); and 40× or 45× (NA 0·65)
Eyepieces	6× or 5×; and 10× or 12×

NOTE — The objectives shall be corrected for cover glass thickness of 0·17 mm.

4.4 A suitable iris or disc diaphragm shall be provided.

4.4.1 The condenser, when provided, shall have a numerical aperture not less than that of the high power objective supplied and shall be provided with an aperture diaphragm. If desired, a filter holder shall be provided.

4.5 The objective shall be supplied in a suitable container.

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*Glossary of terms used in optical technology.

†Dimensions and marking of general purposes microscopes.

‡General requirements for optical components.

§General requirements for optical instruments.

4.6 The case carrying the microscope shall be of well-seasoned wood. Teak ply or board may also be used. It shall be complete with lock and key arrangement, a suitable locking screw for securing the microscope and a cross-piece to retain it in position during transit. The case carrying the microscope shall be of a good general condition with a carrying handle at the top and suitable internal receptacles for holding the eyepieces, objectives and accessories. It should contain a cleaning brush and a bag of silica gel (regenerated) which should be suitably placed inside the case carrying the microscope.

4.7 A suitable sub-stage plane and a concave mirror shall be provided with the microscope. The concave mirror should be able to concentrate a beam upon a small area of the object when the condenser is not in use.

5. FUNCTIONAL REQUIREMENTS

5.1 The coarse and fine focusing motions of the objective relative to the stage or *vice versa* and the movement of the condenser shall be smooth and even. The focusing movement shall remain unaffected by the load of accessories likely to be used with this type of microscope. The iris diaphragm of the condenser shall open and close centrally and smoothly.

5.2 The coarse and fine movement of the objective shall be so restricted by a suitable slide protecting device that it may not, at any time, damage the microslide placed on the stage.

5.3 The fine motion shall be 0·1 to 0·2 mm per revolution of the corresponding knob over a range of 1 to 2 mm.

5.4 The hole in the stage shall be located centrally with respect to the tube and the microscope axis or both.

5.5 The nosepiece shall be smooth in movement without any shake and shall not be displaced by any jerk.

5.6 The objectives and eyepieces should be parfocal to within half a turn of the fine motion knob. It is highly desirable that these parfocal distances be maintained at the values given in IS : 3081-1965*.

5.7 The axis of the optics, when in position, shall coincide with the mechanical axis of the microscope.

5.8 The image of the object shall be well-defined with good contrast rendition and practically free from spurious colour effects, curvature of field over two-thirds of the field of view and distortion.

5.9 The resolving power of each objective shall correspond closely to the theoretical limit.

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*Dimensions and marking of general purposes microscopes.

5.10 The edge of the eyepiece stop should appear in focus and be dull black.

6. TESTS

6.1 Mechanical

6.1.1 The mechanical tube length shall be within ±1 mm of its nominal value of 160 mm.

6.1.2 The stage shall be checked for its squareness to the axis of the microscope maintaining the objective parfocal distance. The deviation from squareness shall not exceed seven minutes of arc.

6.1.3 In changing from one objective to another or reintroducing the same objective by rotation of the nosepiece, the object at the centre of the field shall not appear displaced by more than 0·05 mm in the object plane in any direction.

6.1.4 Operation of the fine motion through its full range shall not appear to displace an object by more than 0·02 mm.

6.1.5 The centring of the condenser shall be checked by rotation in the condenser receptacle. The rotation of the image of a distant object formed by the condenser shall be within ±1 mm.

6.1.6 Parfocality of the objectives and the eyepieces shall be within half a turn of the fine motion knob.

6.2 Optical

6.2.1 *Magnification* — The magnification of the microscope shall be tested by the method given in Appendix J of IS : 2754-1964*.

6.2.2 *Numerical Aperture* — The numerical aperture of the microscope objective shall be tested by the method given in **4.2.3** of IS : 2754-1964*.

6.2.3 *Resolving Power, Definition* — The resolving power of the objective shall be measured by the method given in Appendix K in conjunction with **4.2.4** and **4.2.6** of IS : 2754-1964*.

6.2.4 *Star Test* — The objective shall be tested separately for aberrations over two-thirds of the field of view by the examination of the intra-focal and extra-focal images of a 'Star' object, the latter being artificially produced by suitably illuminating the smallest mercury globules on a piece of glass painted black, placed on the stage of the microscope under test. For observing the diffraction patterns thus formed on either side of the focus of the objectives under test, an auxiliary testing microscope may be used in place of the eyepiece to provide a magnification higher than 15× in doubtful cases; otherwise normally, a 15× eyepiece may be used.

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*General requirements for optical instruments.

6.2.5 *Colour* — The image of a black and white test object shall appear free from colour when observed by illumination with white light over two-thirds of the field of view.

6.2.6 *Curvature of Field* — The image shall be free from curvature of field to the extent of nearly two-thirds of the total field. A microslide with 2 mm divided into 200 parts or 1 mm divided into 100 parts shall be focused under the objective and nearly two-thirds of total number of graduations visible in the field of view shall appear well-defined and be symmetrically located in the field of view.

6.2.7 *Distortion* — A counting-chamber slide or a cross-line grating shall be focused in order to judge visually whether the distortion is excessive.

6.2.8 *Clarity of the Field of View* — No shadow zones along the periphery of the field of view shall be observed. (These can arise due to improper location of stray-light baffles.)

6.2.9 *Condition of Optics* — The optics shall be checked for conformity to the requirements as laid down in IS : 988-1959*.

7. MARKING

7.1 Each microscope shall be marked at a suitable place with the manufacturer's name or trade-mark and the serial number. If required by the purchaser, the microscope may also be marked with the year of manufacture.

7.2 The marking of the objectives and eyepieces shall be according to IS : 3081-1965†.

7.2.1 The containers may also be marked with the Standard Mark.

7.2.2 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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*General requirements for optical components.

†Dimensions and marking of general purposes microscopes.

8. PACKING AND PACKAGING

8.1 The microscope shall be delivered in a thoroughly clean and dry condition, free from all traces of foreign material.

8.2 All the objectives shall be placed in cylindrical containers which, in turn, shall be held in a wooden receptacle fixed or sliding inside the wooden box of the microscope. The eyepieces shall be put in their respective positions in the same receptacle. During transit, the objectives and the eyepieces shall be secured in position.

8.3 The microscope tube or limb, whichever is movable, shall be brought to its lowest position by means of the coarse focusing knob before being put into the case.

8.4 The mirror shall be wrapped in a clean, dry and acid-free tissue paper, which shall be retained in position during transit.

8.5 The condenser unit shall also be suitably wrapped in a clean, dry and acid-free tissue paper.

8.6 The microscope shall then be placed in the case and held in position securely by suitable arrangement.

8.7 A bag of silica gel (regenerated) shall be suitably placed inside the case carrying the microscope.

8.8 The empty spaces, if any, in the receptacles for holding the objectives and eyepieces shall be filled with suitable packing material.

8.9 The wooden box along with its contents, shall be locked during transit and the keys attached to the handle.

8.10 The package shall be marked with the description and the number of contents, the standard symbol for indicating fragile contents (*see* IS : 1286-1958*), the legend ' HANDLE WITH CARE ' in red and the symbol for ' RIGHT-WAY UP '.

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*Pictorial markings for handling instructions for non-dangerous goods.

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